

ELECTRICAL

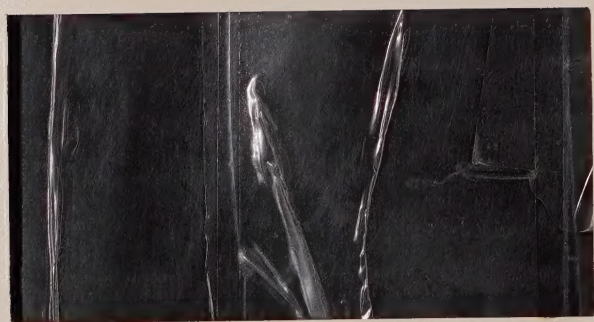
INSTRUCTION MANUAL

1C81



THE BIRTCHER CORPORATION INSTRUMENT DIVISION

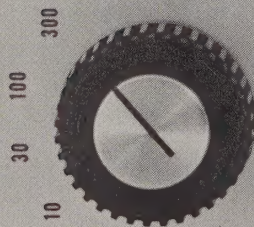
1200 MONTEREY PASS ROAD, MONTEREY PARK, CALIFORNIA



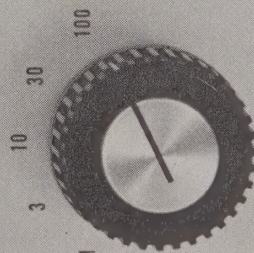
TYPE 10-Z

ZENER DIODE

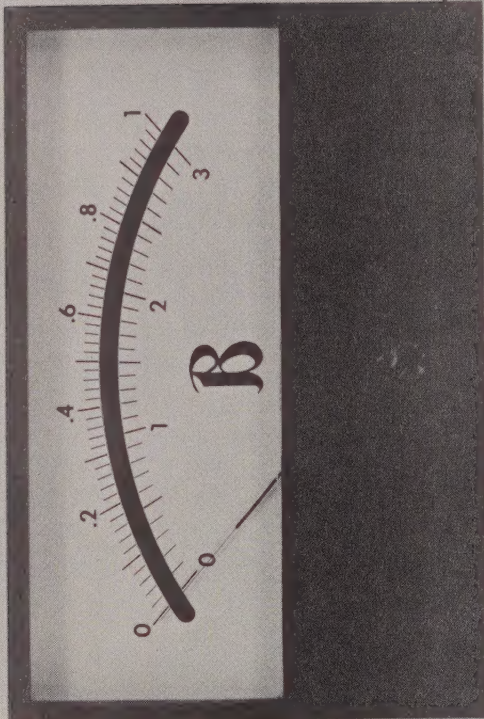
TEST MODULE



VOLTAGE RANGE



CURRENT RANGE (MA)



IMPEDANCE RANGE

THE BIRTCHER CORP.

ZENER DIODE TEST MODULE, TYPE 10-Z

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SECTION 1

GENERAL DESCRIPTION

1.1 INTRODUCTION

The type 10Z Zener Diode Test Module is used with the Birtcher Model 70 Semiconductor Test Set to provide direct reading of important zener diode parameters.

Internal ~~1000~~⁶⁰ cycle oscillator intuned voltmeter provide direct reading of dynamic impedance.

1.2 SPECIFICATIONS

ZENER CURRENT RANGES:

1, 3, 10, 30, 100 ma.

VOLTAGE RANGES:

10, 30, 100, 300.

IMPEDANCE RANGES:

10, 30, 100, 300, 1000.

ACCURACY:

DC measurements $\pm 2\%$ f.s.
AC measurements $\pm 3\%$ f.s.

CONSTRUCTION:

Aluminum alloy chassis. Anodized aluminum front panel with three-color silk screen markings.

WEIGHT:

9 pounds.

DIMENSIONS:

8 $\frac{1}{2}$ " wide X 7" high X 13" deep.

SECTION 2

OPERATION

2.1 GENERAL

For ease and convenience of operation, the front panel of the Model 70 Semiconductor Test Set, including the Type 10Z Zener Diode Test Module has been divided into three functional sections (figure 2-1).

To aid the operator in learning and remembering the basic operation of the instruments, different colors are used for the markings of each section. Black markings refer to the ZENER VOLTAGE controls and meter. Red markings refer to the ZENER CURRENT controls and meter. Blue markings refer to the ZENER IMPEDANCE readout controls.

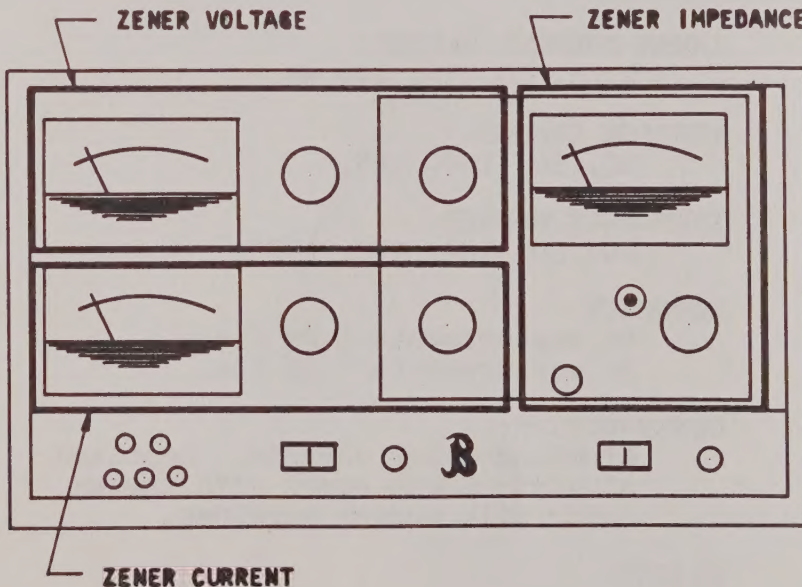


FIGURE 2-1

FRONT PANEL LAYOUT - MODEL 70 WITH 10Z INSTALLED.

2.2 FUNCTION OF CONTROLS AND METERS

VOLTAGE RANGE Switch

Four position rotary switch provides selection of zener voltmeter (upper, Model 70) ranges. Black markings.

ADJUST Control (upper, Model 70)

Not used with the 10Z Test Module.

2.2 FUNCTION OF CONTROLS AND METERS (continued)

METER (upper, Model 70)

Dual-scale, mirror-backed meter; indicates voltage developed across Zener Diode under test. Ranges are selected by VOLTAGE RANGE Switch.

CURRENT RANGE Switch

Five position rotary switch provides selection of zener current supply and meter (lower, Model 70) ranges. Red markings.

ADJUST Control (lower, Model 70)

Uncalibrated control used to adjust current applied to Zener Diode under test. Red markings.

METER (lower, Model 70)

Dual-scale, mirror-backed meter; indicates current flowing through Zener Diode under test. Ranges are selected by CURRENT RANGE Switch.

ZENER IMPEDANCE RANGE Switch

Six position rotary switch used to select the zener impedance meter (located on module) ranges; also, provides a calibrated position for adjustment of oscillator level. Blue markings.

CALIBRATE Control

Potentiometer for adjustment of oscillator level when AC RANGE Switch is positioned to the CAL position.

AC Meter

Dual-scale, mirror-backed meter; indicates AC impedance of Zener Diode under test. Ranges are selected by ZENER IMPEDANCE RANGE Switch.

CAUTION !

In order to properly test Zener Diodes, a high-voltage, high-current power supply must be used. The type 10Z Zener Diode Test Module used with the Model 70 Semiconductor Test Set provides voltages up to 300 volts at 100 milliamperes. Great care must be taken when working with voltages of this magnitude; carelessness could result in painful or serious injury, or a fatality.

2.3 INITIAL TURN ON

1. Put TEST switch in RESET position.
2. Turn lower ADJUST control fully counter-clockwise.
3. Put POWER switch in ON position.
4. Turn ZENER IMPEDANCE RANGE switch to CAL.
5. Adjust CAL for full scale deflection of ZENER IMPEDANCE METER.

2.4 ZENER DIODE TEST

1. Set CURRENT RANGE switch to desired zener current range.
2. Set VOLTAGE RANGE switch to expected zener voltage.
3. Set ZENER IMPEDANCE RANGE switch to expected impedance range.
4. Depress TEST switch.
5. Turn lower ADJUST control until desired zener test current is indicated on ZENER CURRENT METER.
6. Read zener impedance on ZENER IMPEDANCE METER.
7. Read zener voltage on voltage meter.

NOTE: Use correction graph for correction factor when AC RANGE switch is in 300 and 1000 positions.

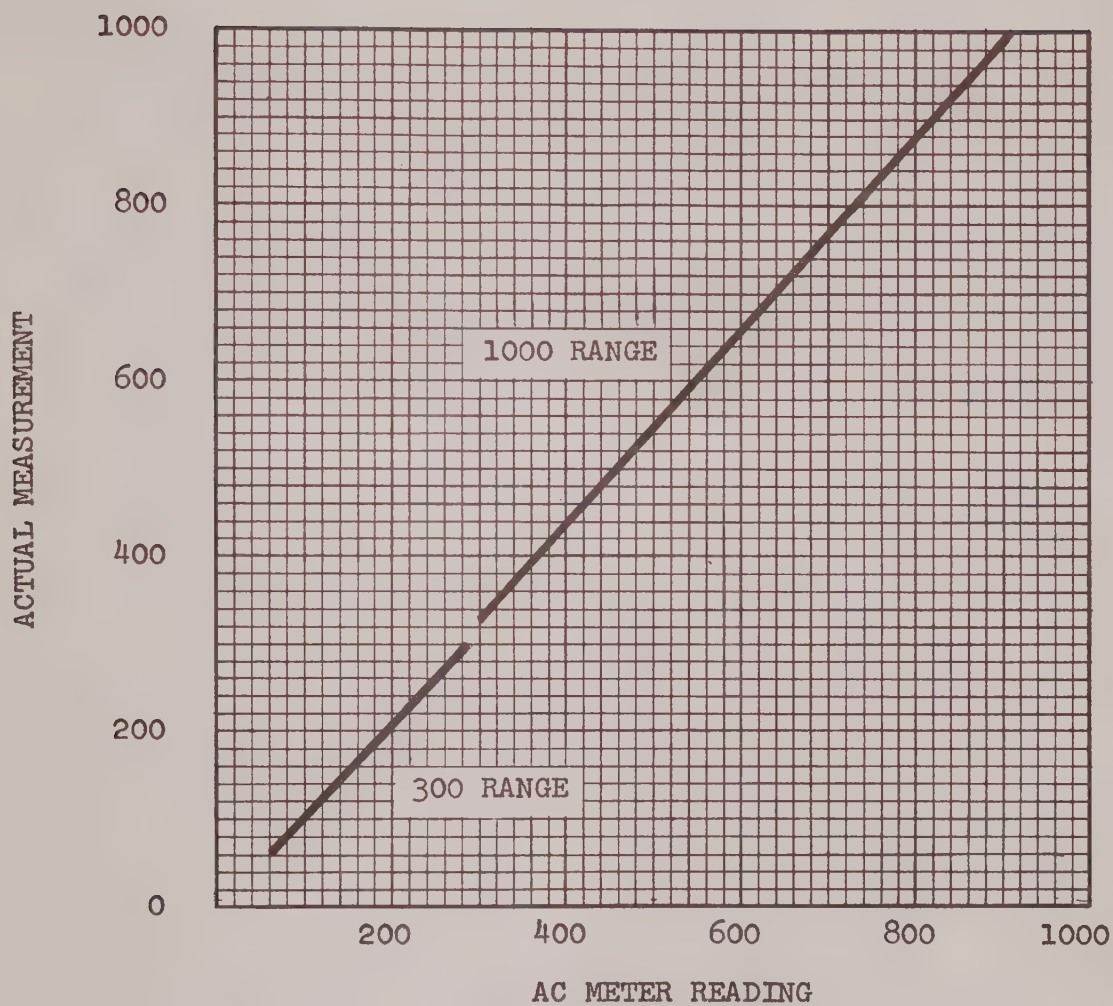


FIGURE 2-2
AC METER CORRECTION GRAPH
TYPE 10Z TEST MODULE

SECTION 3

THEORY OF OPERATION

With the Type 10Z, the zener diode is connected as shown in the BLOCK DIAGRAM figure 3-1. Current for biasing the zener diode is generated by a voltage supply with series current limiting resistors. Current is adjusted by adjusting the voltage supply output.

Zener impedance is measured by feeding constant current of 100 ua. (derived from a 10K resistor in series with the 1 volt output of the 1KC voltage developed across it. The AC signal is prevented from flowing into the current supply by the high impedance of the current limiting resistors.

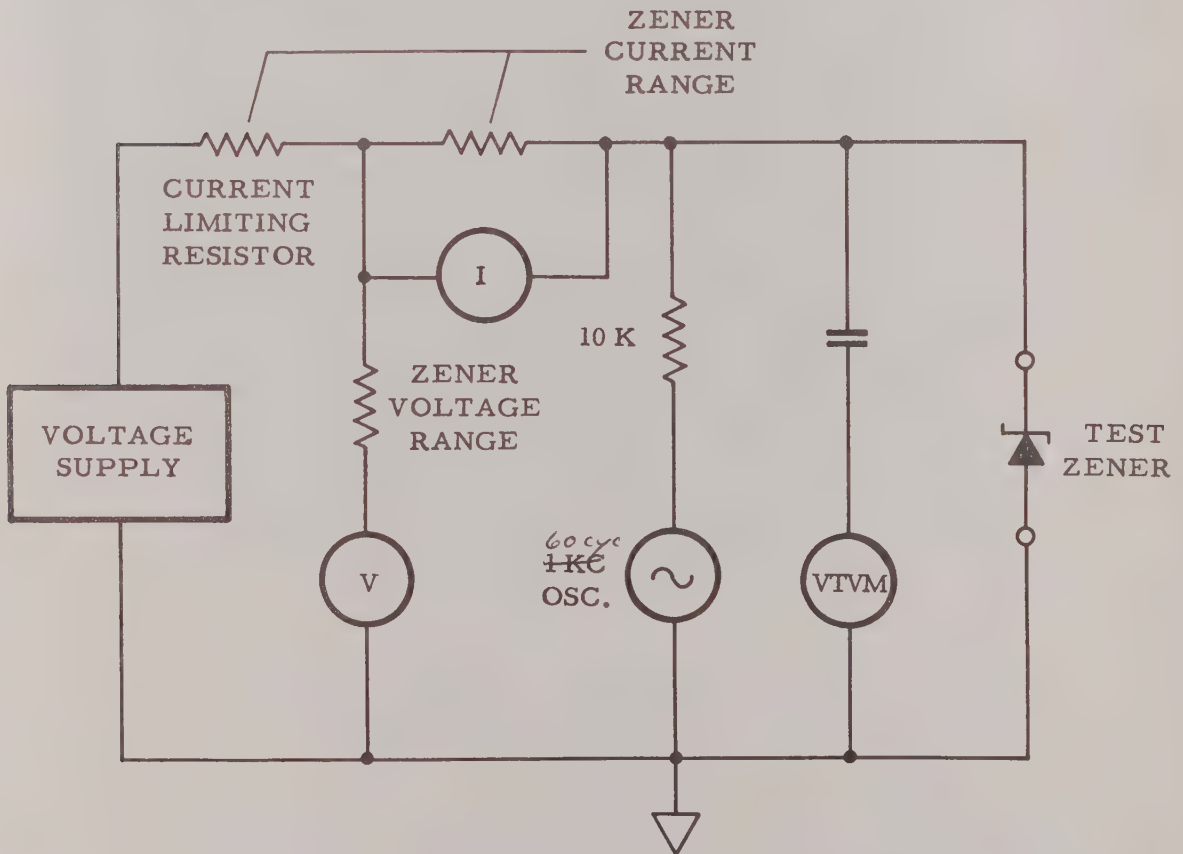


FIGURE 3 - 1

FUNCTIONAL BLOCK DIAGRAM, Model 70 with 10Z installed.

SECTION 4

CIRCUIT DESCRIPTION

4.1 ZENER CURRENT SUPPLY

The Zener current supply provides variable current to the Zener Diode under test.

Variable transformer T104 (lower ADJUST control) supplies 60 cycle AC to the primary of T103. The voltage developed across secondary winding terminals 5 and 10 on T103, is full wave rectified by diode bridge D201 thru D204. Capacitors C201, C202, and inductor L201 are used to filter the DC voltage. Resistors R201 thru R205 in series with the positive output of the current supply are used to provide current limiting. These resistors are selected by S201 (ZENER CURRENT RANGE switch).

Voltage from the common side of the current limiting resistors is applied through the current measuring resistors R207 thru R211 to the cathode test terminal. The voltage developed across current measuring resistors is applied to M101 (lower, Model 70) for current indication.

Zener voltage is indicated on M102 (upper, Model 70). The proper range resistors are selected by S202 (ZENER VOLTAGE RANGE). The voltage on the common of S202 is applied to the negative terminal on the meter M101. The positive input of M101 is connected to the common side of the current eliminating resistors.

4.2 1000 CYCLE OSCILLATOR

The 1000 cycle oscillator is used to generate the input signal for measurement of the hybrid parameters. The 1KC signal is generated by phase-shift oscillator V202, the pentode section of a type 6U8A tube. Feedback from plate to grid is provided by phase-shift network C209, R234, C210, R235, C211, and R236 which, with the 180 degree phase-shift through the tube makes the feedback signal in phase with the original signal on the grid, thereby generating and sustaining oscillation. The proper phase-shift to maintain oscillation occurs essentially only at a frequency of 1KC thus causing the output from this section to be very nearly a pure sine wave.

4.2 1000 CYCLE OSCILLATOR (continued)

The output from the plate of V202A is coupled to the grid of amplifier V202B (the triode section of V202) through capacitor C214 and a voltage divider consisting of resistor R213 and variable resistor R245.

Variable resistor R245 is the calibrate control which is used to adjust the input to V202B so a standardized 1KC signal is applied to the transistor being tested.

Cathode bias for V202B is provided by resistor R239 is left unbypassed to provide negative feedback and minimize the distortion V202B. The output at the plate of V202B is developed across the primary of output transformer T201 which provides an impedance match for a 10 ohm load. The primary of T201 is tuned to 1KC by capacitor C227. The output at the secondary of T201 is applied through the FUNCTION switch to the transistor being tested.

An operating potential of regulated 150 volts DC is supplied to V202. Resistor R240 and capacitor C215 form a decoupling network to prevent any 1KC signal from entering the vacuum tube voltmeter circuit through the common power supply.

4.3 TUNED VACUUM TUBE VOLTMETER

The vacuum tube voltmeter is used to provide direct readout of the hybrid parameter being tested.

The input signal to the VTVM circuit is selected by deck 5 on S201 (FUNCTION). The signal selected by S201 is coupled through capacitor C205 to the high side of attenuator R205 and R207 thru R211. In the first five positions of AC RANGE switch S204, a fraction of the total applied 1KC signal selected by section 5 of S204 is applied to the grid of V203.

When S204 is operated to CAL, the oscillator output is applied to the input of V203 through a 1000 to 1 voltage divider, R204 and R205. Standardized oscillator output is then obtained by adjustment of calibrate control R245 to produce full-scale deflection on meter M201.

The output of V203 resulting from the input signal selected by S201 and S204 is developed across plate load resistor R248 and coupled by attenuating network C221 and R250 to the tuned circuit consisting of inductor L203 and capacitors C220 and C219. The tuned circuit minimizes the response of the circuit to signals at other than a frequency of 1KC, thus providing essentially noise-free response.

4.3 TUNED VACUUM TUBE VOLTMETER (continued)

The output of the filter is coupled by capacitor C222 to the grid of V204A, one section of triode type 12AX7A. The output of this stage is coupled by capacitor C223 to the grid of V204B. The output of V204B is coupled to bridge rectifier D208 through D211. Meter M201 indicates the magnitude of the rectified output from the bridge rectifier and this indication represents the value of the transistor parameter being measured.

Negative feedback voltage, applied from the output of V204B through the bridge rectifier, is developed across resistor R252 to provide gain stabilization of V204A and V204B. Overall gain is such that full scale indication on M201 is obtained with approximate 1 MV pp input to the grid of V203.

4.4 AUXILIARY POWER SUPPLY

Transformer T101 is used to convert 115 VAC line voltage for plate and filament supplies.

Secondary winding 3 thru 5 is connected to D206 and D207 to supply high-voltage, full wave rectified output.

C208 and R232 form a capacitor input RC filter for the VTVM plate supply. Plate voltage for the 1KC oscillator and VTVM preamplifier is regulated by V201.

Filament voltages are supplied by secondary windings 5 thru 6 on T101.

SECTION 5

MAINTENANCE

5.1 INSTRUCTION MANUAL

A Birtcher Instruction Manual usually contains hand-made changes to diagrams and parts lists and sometimes texts. These changes are generally appropriate only to the instrument the manual was prepared for. These hand-made corrections show changes to the instrument that have been made after the printing of the manual.

There is a serial number on the warranty page of this manual. This is the serial number of your instrument. Be sure the manual number matches the instrument number when you order parts.

NOTE: Always include the instrument type and serial number in any correspondence regarding the instrument.

5.2 REPLACEMENT PARTS

5.2.1 Standard Components

Birtcher will supply replacement components at current net prices. However, since most of the components are standard electronic and radio parts, you can probably obtain them locally faster than we can ship them to you from the factory in Monterey Park, California. Be sure to consult the parts list to see what tolerances are required.

5.2.2 Selected Components

We specially select some of the components whose values must fall within prescribed limits. By sorting through our regular stocks the components so selected will have standard retma color coding showing the value and tolerance of the stock they were selected from, but they will not in general, be replaceable from dealer stock.

5.2.3 Birtcher Manufactured Parts

Birtcher manufactures almost all of the mechanical parts and some of the components used in the instrument. If you order a mechanical part be sure to describe the part completely to prevent any unnecessary delay in filling your order. When you have any questions about mechanical parts or Birtcher manufactured components, contact our nearest field sales representative or write to the service department at the factory in Monterey Park, California.

5.3 REMOVAL AND REPLACEMENT OF PARTS

The procedures required for replacement of most parts in the type 10Z are obvious. Detailed instructions for their removal are not required. Other parts, however, can be best removed if a definite procedure is followed. Instruction for the removal of some of these parts are contained in the following paragraphs.

5.3.1 Replacement of Switches

Methods of removal of defective switches are, for the most part, obvious and only a normal amount of care is required. Single wafers are normally not replaced on the switches used in the type 10Z and if one wafer is defective, the entire switch should be replaced. Switches may be ordered from Birtcher either wired or unwired, as desired.

5.3.2 Replacement of PC Board Components

Some components in the 10Z are mounted on a printed circuit board. To avoid damage to the PC board when replacing components the following precautions should be observed:

1. Use a low power soldering iron (50 watts maximum).
2. Use only a high quality rosin core solder. NEVER a paste flux. After soldering, clean off any excess flux.
3. When replacing components with multiple mounting pins such as tubes, potentiometers etc., it will be necessary to lift each pin slightly, working around the components several times until it is free.

5.4 CALIBRATION

5.4.1 Preliminary

The type 10Z Zener Diode Test Module is a stable instrument and should never require internal adjustment affecting calibration. However, a periodic performance check is desirable from a standpoint of preventative maintenance.

The following equipment is necessary for a complete performance check of the 10Z Test Module.

1. Precision DC Microammeter. 0-1 ma. 1% accuracy. Simpson model 1702, 1703 or equivalent.

5.4.1 Preliminary (continued)

2. Precision DC voltmeter to cover range from 3 to 300 volts with 1% accuracy. Simpson model 1700 or equivalent.
3. Precision resistor decade with values from 1 ohm to 1K; $\frac{1}{2}\%$ accuracy.

Connect the 10Z to the Model 70. Install the diode test adapter. Mechanically zero all meters.

5.4.2 Impedance Measurement

The accuracy of the impedance measurement made with the 10Z can be checked by the following procedure, employing only passive precision elements.

1. Place front panel controls in the following positions:

TEST	RESET
ADJUST Controls	CCW
ZENER CURRENT RANGE	1 ma.
ZENER VOLTAGE RANGE	10
AC RANGE	CAL

2. Turn POWER on and allow a 5 minute warm-up.
3. Adjust CAL control for full scale indication on AC voltmeter.
4. Connect the resistance decade between the diode test terminals.
5. Set the resistance decade to 10 ohms.
6. Set the AC RANGE switch to the 10 position.
7. Depress TEST switch.
8. AC meter should indicate full scale $\pm 3\%$. (indication may be slightly high due to resistance of test leads)
9. Set AC RANGE switch to 30 range.
10. AC meter should be at $1/3$ full scale indication (10 ohms on the 30 ohms range).
11. Set AC RANGE switch to 100 range.
12. Increase decade resistance to 10 ohms steps and observe linearity. Maximum error allowable is 3% of full scale indication.

5.4.3 Zener Current Measurement

1. Place front panel controls in the following position:

TEST	RESET
ADJUST Controls	CCW
ZENER CURRENT RANGE	1 ma.

2. Connect microammeter (1 ma. range) between anode (-) and cathode (+) test jacks.
3. Depress TEST switch.
4. Increase ZENER CURRENT ADJUST control (lower, Model 70). The ZENER CURRENT meter should indicate full scale $\pm 2\%$.

5.4.4 Zener Voltage Measurement

1. Place front panel controls in the following positions:

TEST	RESET
ADJUST Controls	CCW
ZENER VOLTAGE RANGE	10 volts
ZENER CURRENT RANGE	100 ma.

2. Connect voltmeter (10 volt full scale range) between anode (-) and cathode (+) test jacks.
3. Depress TEST switch.
4. Increase ZENER CURRENT ADJUST control (lower, Model 70) for 10 volt indication on external meter. Zener voltmeter should indicate full scale $\pm 2\%$.
5. Repeat for 30, 100 and 300 volt ranges.

5.5 FACTORY ADJUSTMENT

For the test set to operate properly, the tuned circuit in the VTVM and the oscillator must be tuned to the same frequency, a moderate amount of adjustment of frequency is provided in the VTVM by trimmer capacitor C219.

Equipment required for this adjustment is a module connector cable, Birtcher P/N B5536 and a non-metallic screwdriver.

5.5 FACTORY ADJUSTMENT (continued)

Connect the 10Z Test Module to the Model 70 with the module connector cable. Proceed with the adjustment as follows:

1. Turn on the test set and allow it to warm-up for at least 5 minutes.
2. Operate AC RANGE switch to CAL.
3. Rotate calibrate control (above AC RANGE switch) to the extreme right, then back off slightly.
4. Use a non-metallic screwdriver and adjust C219 to obtain a maximum indication on the module meter. If the meter indication tends to go beyond the full scale, rotate calibrate control to the left to keep the indication within the limits of full scale indication with calibrate control less than full to the right.

SECTION 6

PARTS LIST

<u>CAPACITORS</u>	<u>DESCRIPTION</u>	<u>PART NUMBER</u>
C 201	150 MFD @ 350 VDC Electrolytic	104-003
C 202	150 MFD @ 350 VDC Electrolytic	104-003
C 203	.1 MFD @ 500 VDC Disc	100-076
C 204	.05 MFD @ 600 VDC Disc	100-078
C 205	40-40 MFD @ 300 VDC Electrolytic	104-100
C 209	330 MMFD @ 500 VDC, Mica	101-050
C 210	100 MMFD @ 500 VDC, Mica	101-025
C 211	33 MMFD @ 500 VDC, Mica	100-000
C 212	40 MFD @ 6 VDC Electrolytic	104-004
C 213	8 MFD @ 150 VDC Electrolytic	104-005
C 214	.05 MFD @ 600 VDC Disc	100-078
C 215	8 MFD @ 150 VDC Electrolytic	104-005
C 216	8 MFD @ 150 VDC Electrolytic	104-005
C 217	40 MFD @ 6 VDC Electrolytic	104-004
C 218	8 MFD @ 150 VDC Electrolytic	104-005
C 219	190-190 MMFD @ 175 VDC Variable Trimmer	105-000
C 220	.0015 MFD @ 500 VDC, Mica	101-075
C 221	.005 MFD @ 1000 VDC Disc	100-077
C 222	1 MFD @ 500 VDC Disc	100-076
C 223	.01 MFD @ 600 VDC Disc	100-075
C 224	.1 MFD @ 500 VDC Disc	100-076
C 225	4 MFD @ 250 VDC Electrolytic	104-008
C 227	.015 MFD @ 400 VDC, Mylar	102-050

DIODES

D 201	5A7	740-005
D 202	5A7	740-005
D 203	5A7	740-005
D 204	5A7	740-005
D 205	5A6	740-002
D 206	5A6	740-002
D 207	1N1692	740-006
D 208	1N118	740-003
D 209	1N118	740-003
D 210	1N118	740-003
D 211	1N118	740-003

RELAY

K 201	DPDT 6 VDC	540-001
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CHOKES

L 201	10 Hy. @ 100 Ma.	B76042
L 203	10 Hy. Torroid	B76041

<u>METER</u>	<u>DESCRIPTION</u>	<u>PART NUMBER</u>
M 201	50 Ma. Full-Scale $\pm 1\%$ 2.5 K $\pm 20\%$ Int. Res.	540-001
<u>RESISTORS</u>		
R 201	1K, 10 Watt, Wirewound	553 100
R 202	3K, 5 Watt, Wirewound	553-125
R 203	10K, 1 Watt	550 102
R 204	27K	550-128
R 205	100K	550-127
R 207	1.25 Ohm, 1%, Wirewound	553 001
R 208	4.15 Ohm, 1%, Wirewound	553-000
R 209	12.6 Ohm, 1%, Wirewound	553-052
R 210	41.7 Ohm, 1%, Wirewound	553-051
R 211	131 Ohm, 1%, Metal Film	552-001
R 212	10K, 1%, Metal Film	552-027
R 213	1.5M	550 179
R 214	6M, 1%, Der. Carb.	551 076
R 215	2M, 1%, Der. Carb.	551 075
R 216	597K, 1%, Metal Film	552-078
R 217	198K, 1%, Metal Film	552-075
R 218	700K, 1%, Metal Film	552-077
R 219	245K, 1%, Metal Film	552-076
R 220	70K, 1%, Metal Film	552-053
R 221	24.5K, 1%, Metal Film	552 052
R 222	10.5K, 1%, Metal Film	552 051
R 223	180 Ohm	550 027
R 224	3K, 5 Watt, Wirewound	553-125
R 225	10 Ohm	550-001
R 226	10K, 10 Watt, Wirewound	553-128
R 234	180K	550 155
R 235	560K	550-154
R 236	1.8M	550-180
R 237	2.7K	550-076
R 238	220K	550 150
R 239	1.2K	550 075
R 240	1K	550-053
R 241	47K	550-126
R 242	100K	550-127
R 243	10 Ohm, 1%, Wirewound	553-025
R 245	1M, Variable	554-075
R 246	1K	550 053
R 247	5.6K	550 081
R 248	150K	550 156
R 249	10K	550 101
R 250	470K	550 152
R 251	10M	550-177
R 252	82 Ohm	550 028
R 253	10M	550-177
R 254	1M	550 175
R 255	47K	550 126
R 256	470 Ohm	550 052
R 257	4.7K	550 078

SWITCHESDESCRIPTIONPART NUMBER

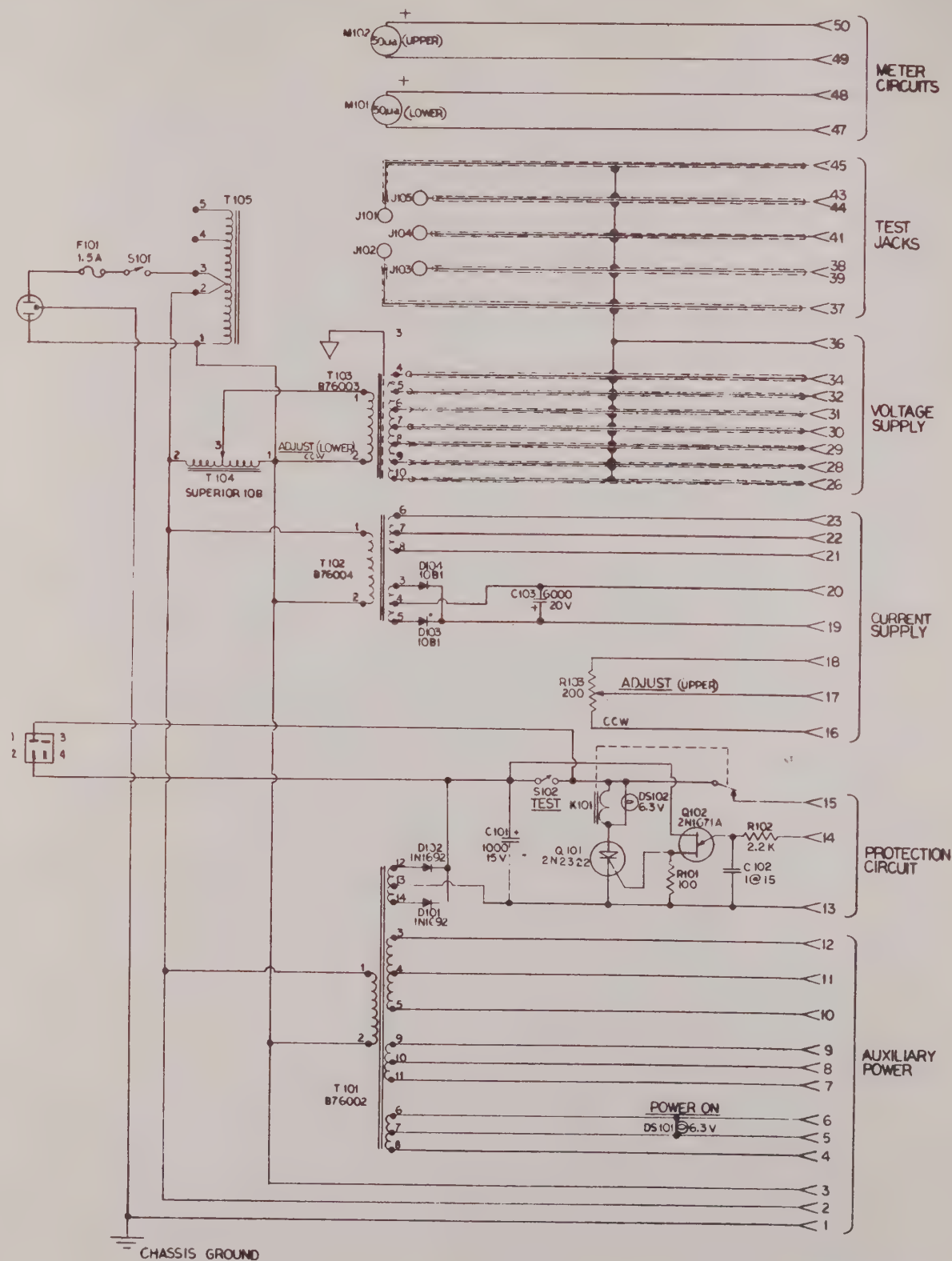
S 201	Rotary, 2 Pole, 5 Position (S)	A76091
S 202	Rotary, 1 Pole, 4 Position (NS)	A76092
S 203	Rotary, 3 Pole, 6 Position (NS)	A76090

TRANSFORMER

T 201	Transformer	B76043
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TUBES

V 201	0A2	910 000
V 202	6U8A	910 101
V 203	6AU6A	910 100
V 204	12AX7A	910 150



4. ALL RESISTANCES IN OHMS.

3. UNDERLINED CONTROL DESIGNATIONS APPEAR ON FRONT PANEL.

2. ALL CAPACITANCES, IN μ F.

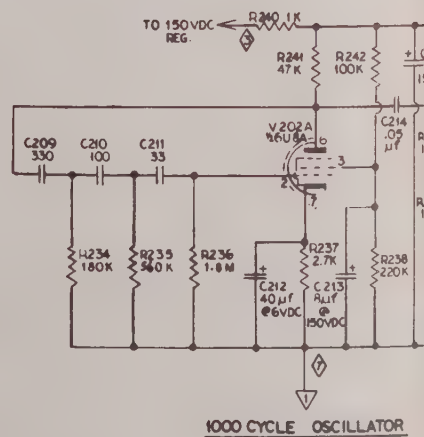
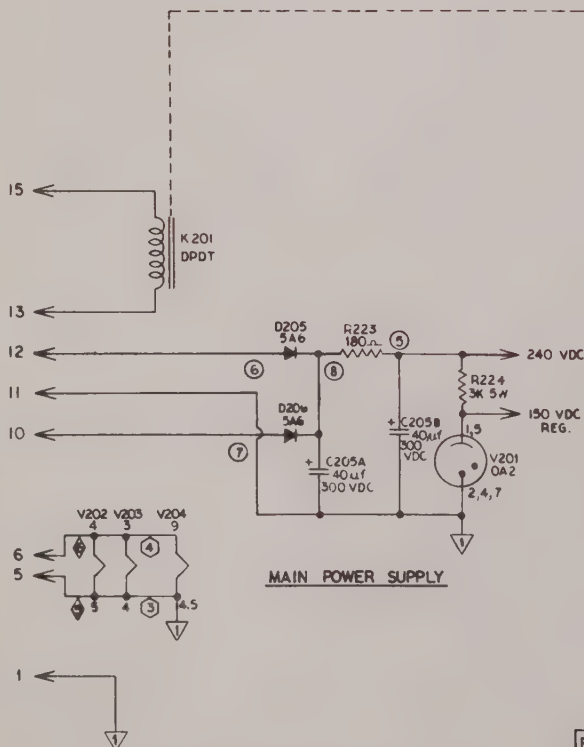
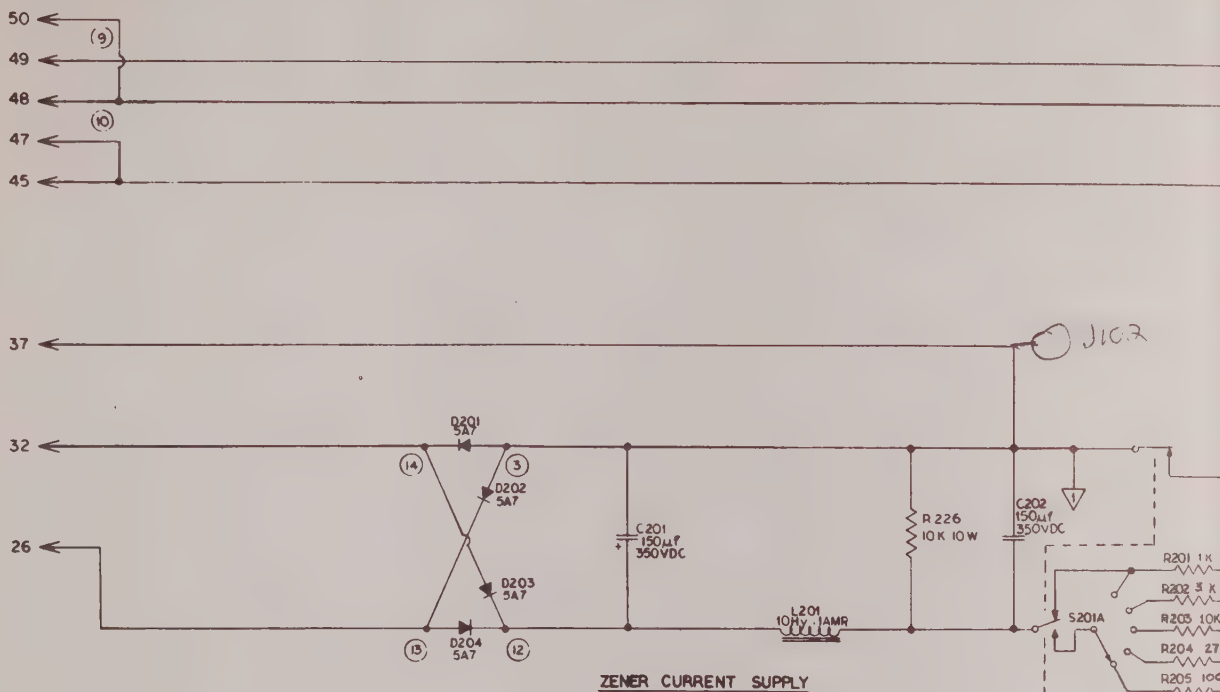
1. ALL RESISTORS, $\frac{1}{2}$ W $\pm$ 10% CARBON.

NOTES: UNLESS OTHERWISE SPECIFIED.

REV	DESCRIPTION	DATE	DRWN	APPD
C	GROUNDING TERMINAL 3 ON T103	3-11-64	E.B.	RM
B	REMOVED R104, R105 & D105 REVISED PROTECTION CIRCUIT. R101 WAS 220 Ω R102 WAS 100 Ω , C102 WAS 5, Q101 WAS TI1550.	4-23-64	A.W.	RM
A	ADDED D105 IN 118	5-18-64	L.M.	J.H.
REV	DESCRIPTION	DATE	DRWN	APPD
	REVISIONS			

BIRCHER CORP./INDUSTRIAL DIVISION
MODEL 70-A
SEMICONDUCTOR TEST SET
BASIC UNIT
SCHEMATIC

DRWN: A.V.K. APPD: RM
DATE: 6-25-62. DATE: 3-5-63

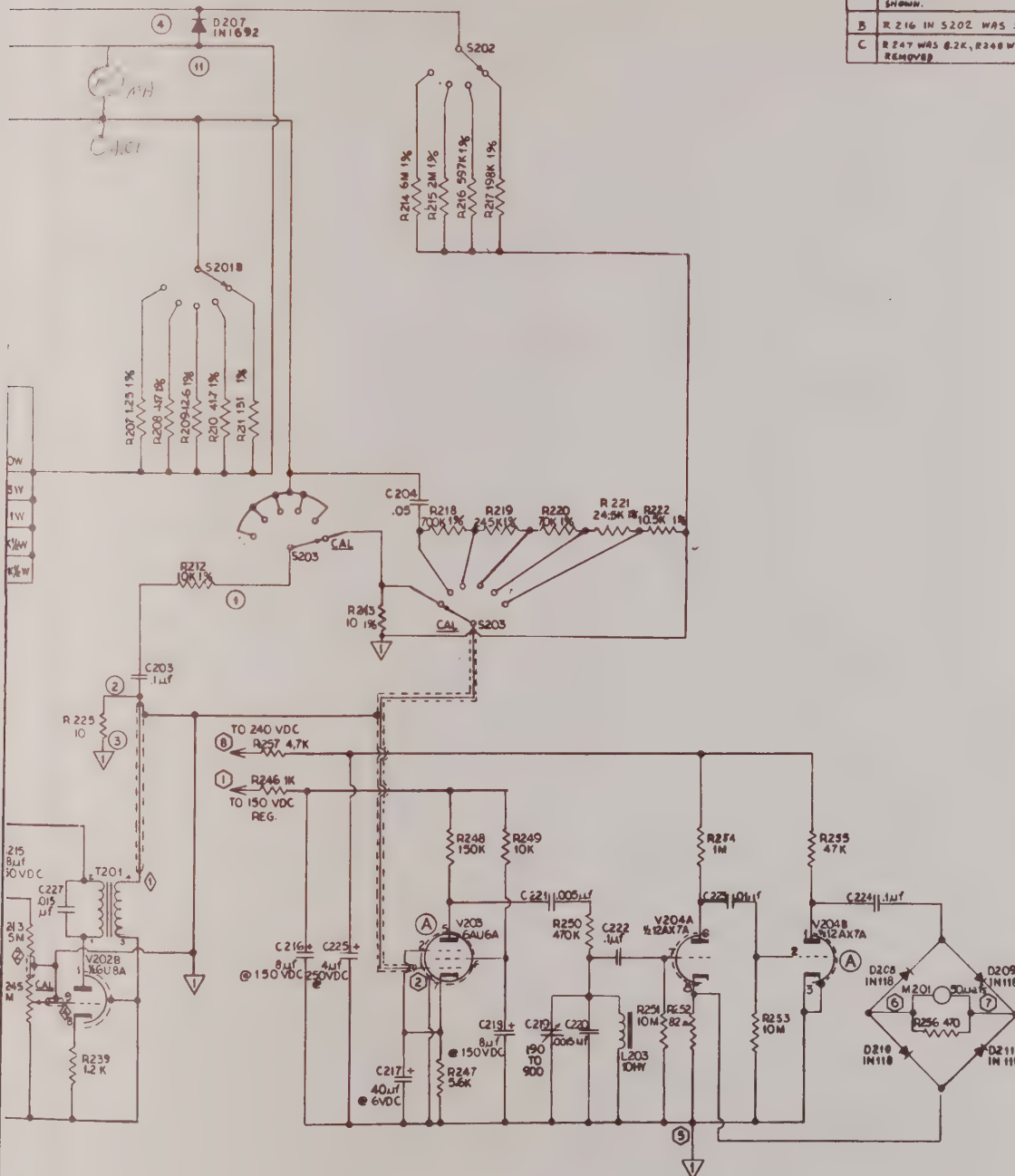


5. PC BOARD NO'S: OSCILLATOR BOARD, VOLT-METER BOARD,
 POWER SUPPLY BOARD (A)
 4. ALL CAPACITORS 200 V.
 3. ALL CAPACITANCES IN μmf .
 2. ALL RESISTORS $\frac{1}{2}$ W, 10% CARBON.
 1. ALL ROTARY SWITCHES SHOWN IN CCW POSITION.
 NOTES: UNLESS OTHERWISE SPECIFIED.

FRONT PANEL CONTROLS:	
S 201	ZENER CURRENT RANGE
S 202	ZENER VOLTAGE RANGE
S 203	ZENER IMPEDANCE RANGE

REVISIONS

NO.	DESCRIPTION	DATE	OWN	APP
A	R-201, R-202, R-203, R-204, R-205 C-220 - (N6) D. TERMINAL NO. ON T-201, P.C. BOARD NO. (NOTE 5 ADDED. TUBE SHIELDS SHOWN.)	1/7/68	AWK	AWK
B	R-216 IN S202 WAS 538K 1%	1.20.68	AWK	AWK
C	R-247 WAS 8.2K, R-248 WAS 330K. R-268 (4MA) REMOVED	2.14.68	AWK	AWK



TUNED A.C. VOLTMETER

BIRCHER CORR/INDUSTRIAL DIVISION.

MODULE, TYPE 10Z

SCHEMATIC.

DRAWN: A.V.K.

DATE: 8.13.62

APPRO'D:

DATE

REV. C

WARRANTY

All our products are warranted against defects in materials and workmanship for one year from the date of shipment. Our obligation is limited to repairing or replacing parts which prove to be defective during the warranty period. We are not liable for consequential damage.

For assistance of any kind, including help with instruments under warranty, contact your authorized Birtcher sales representative for instructions. Give full details of the difficulty and include the instrument model and serial number. Service date or shipping instruction will be promptly sent to you. There will be no charge for repair of instruments under warranty, except transportation charges. Estimates of charges for non-warranty or other service work will always be supplied if requested before work begins.

Serial Number 10Z

